Healing complex neonatal dehisced surgical wounds with fish skin graft.

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Background

Neonatal intestinal stomas comprise 5% of surgeries. Most stomas are due to acquired injuries such as necrotizing enterocolitis or congenital diseases such as intestinal atresia & anorectal malformations. Most neonatal stomas are either ileostomies or colostomies, double barrel and usually temporary.

Challenges with neonatal stomas :

- Friable, inflamed and injured intestinal loops.
- Short intestines, leading to challenging location of ostomy and mucous fistula.
- Minimal space around the ostomy to apply appliances and very close proximity to umbilicus, surgical incision and inguinal area.
- Significant risk of wound dehiscence / location of wound next to ostomy.
- Colonization or infection with microbial pathogens.

Challenges and needs of intestinal wounds

Challenges in treating dehisced intestinal/ peristomal wounds:

- Close proximity of ostomy/ need for appliance application
- Need for infrequent non-invasive dressing changes, with minimal manipulation as "hands-on" is poorly tolerated.
- Need for dressing application in the NICU by the bedside
- Neonates with ostomies are nutritionally challenged, which may slow down healing

Needs are:

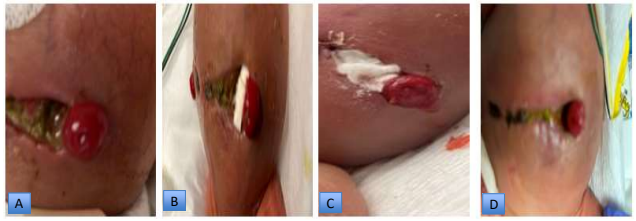
- Need for gentle, non-toxic products
- Need for anti-microbial topical products as skin is often colonized
- Need for anti-inflammatory topicals as neonates have minimal anti-oxidant activity
- Need for product stimulating extracellular matrix (ECM) growth

Why Acellular Fish Skin Graft?

- Intact acellular fish skin graft(FSG), piscine xenograft minimally processed from the skin of North Atlantic cod. Graft has unique porosity and infrastructure that mimics human three-dimensional skin, facilitating endogenous cells ingrowth.
- FSG is rich in fats, collagen, fibrin, fibronectin, proteoglycans &glycosaminoglycans.
- FSG retains high concentration of omega-3 polyunsaturated fatty acids. Omega-3 PUFA pathway produces anti-inflammatory messengers, anti-microbial peptides, promote fibroblast proliferation, endothelial revascularization and extracellular matrix remodeling.
- FSG has long shelf life and is cost effective, compared to other biologic dressings.
- Easy to apply, including neonatal patients housed in the ICU without the need for transport to operating room or need for surgical subspecialties.

Case1

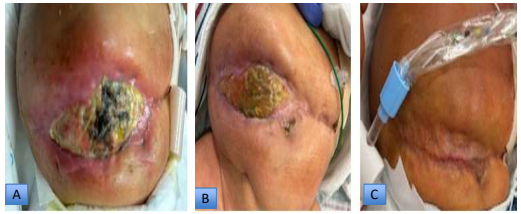
35-day-old, ex-23-week GA neonate with a history of surgical necrotizing enterocolitis, requiring extensive bowel resection, ostomy and mucous fistula creation, followed by two bouts of wound dehiscence. He was critically ill, edematous, and malnourished due to "short bowel" and hypercatabolic state. The wound was challenging to dress due to its proximity to ostomy, where an appliance hindered access to the full wound and very limited tolerance of any "hands-on" care. His first dehiscence was successfully closed with collagen therapy; the second did not respond as well. The skin was thin and friable, and overall immune and proliferative systems were weak and likely deficient in nutrients and growth factors. Solid FSG sheet was cut into multiple small pieces, rehydrated with normal saline, and applied across the wound surface.



1A :Dehiscence before FSG application.
1B: Adding FSG
1C: FSG covered by hydrofiber due to moderate exudate. Hydrocolloid sheet was placed over the wound as a base for ostomy appliance placement. Application of FSG was repeated in 10 days for a total of 2 applications.
1D:Wound closed completely in 4 weeks.

Case2

FT neonate born with congenital heart disease(CHD) undergone repair. Post-operative course was protracted and complicated by two bouts of enterocolitis, feeding intolerance& strictures development, requiring intestinal resection of 2 areas. He failed extubation and developed severe pulmonary hypertension. One week after resection, his abdominal wound dehisced. Wound was colonized by Gram neg org. Initial management by surgery included packing with silver impregnated hydroxymethylcellulose, but no improvement was appreciated after 1 week. Increased slough and thickened wound edges can be appreciated. Patient could not tolerate "hand-on care" and required continuous sedation. Strategy was changed to debree the wound bed once a day with an enzymatic debrider and mechanical polyester monofilament lolly moistened with hypochlorous acid once a day for 2 days. FSG sheet was pre-moistened with NS and placed on the wound bed.



2A:Wound before debridement. Note slough, partial necrotic eschar, thickened inflamed edges.
2B:Day 10. S/P 1 application of FSG. Note wound is significantly smaller with minimal depth. Edges are no longer inflamed. Thin slough was observed after 2 days. Wound was cleaned with hypochlorous acid solution prior to FSG #2 placement.
2C:Healed wound with a healthy, thin scar 7 weeks after 1st FSG application. Most of the wound epithelialized by 4 weeks.

Conclusion

I recommend considering FGS dressing in any dehisced neonatal and pediatric wound. Ease of application and long shelf life facilitate in-unit application. Unique biochemical properties, minimal manipulation and lack of cross reactivity with human immune system make this advanced biologic dressing a safe choice for this vulnerable population. Efficient, once-a-week application, reasonable cost and expeditious wound closure promote earlier discharge and patient satisfaction.

Poster sponsored by Keresis